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|--|-------------|----------------------|---------------------------------------|------------------|
| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.                   | CONFIRMATION NO. |
| 10/672,346   | 09/26/2003  | Joon-Seo Son         | 11948.12                              | 9664             |
| <div>7590<br/>KIRTON &amp; McCONKIE<br/>1800 Eagle Gate Tower<br/>60 East South Temple Street<br/>P.O. Box 45120<br/>Salt Lake City, UT 84145-0120</div> |             |                      | <div>EXAMINER<br/>IM, JUNGHWA M</div> |                  |
|  |             |                      | <div>ART UNIT<br/>2811</div>          |                  |
| SHORTENED STATUTORY PERIOD OF RESPONSE   |             | MAIL DATE            | DELIVERY MODE                         |                  |
| 3 MONTHS   |             | 01/12/2007           | PAPER                                 |                  |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

|                              |                                      |                                   |  |
|------------------------------|--------------------------------------|-----------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/672,346 | <b>Applicant(s)</b><br>SON ET AL. |  |
|                              | <b>Examiner</b><br>Junghwa M. Im     | <b>Art Unit</b><br>2811           |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
  - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
  - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
  - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 October 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-17, 19-23 and 25-27 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17, 19-23 and 25-27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some    \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 6-8, 11-17, 19-23 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wakefield (US 5598034) in view of Lacap (US 5905299).

Regarding claims 1 and 6, Fig. 1 of Wakefield shows a discrete package comprising:

a lead frame pad [11] which has a first surface and a second surface, the second surface which is the opposite surface of the first surface;

leads [20 in Fig. 2] connected to a side of the lead frame pad;

a semiconductor chip [36] attached to the first surface of the lead frame pad;

a ceramic layer [10; column 5, lines 18-34] having a first and second surface and which is positioned directly to the second surface of the lead frame pad; and

a molding material [14] which entirely encapsulates the lead frame pad, the semiconductor chip, and a portion of the ceramic layer, except the leads and the second surface of the ceramic layer.

Fig. 1 of Wakefield shows most aspects of the instant invention except that "the lead frame pad is held in contact with the ceramic layer by using only the molding compound." Fig. 2 of Lacap shows the lead frame pad [210] is held in contact with the ceramic layer by using only the molding compound [204] (col. 6, lines 17-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Lacap into the device of Wakefield in order to have the lead frame pad directly contacting the ceramic layer without an adhesive for better heat transfer.

Regarding claims 2 and 7, Fig. 1 of Wakefield shows that the leads are stepped with respect to the lead frame pad.

Regarding claims 3 and 8, Wakefield discloses that the discrete package further comprising wires which electrically connect the leads to the semiconductor chip (column 4, lines 32-36).

Regarding claims 11 and 14, Fig. 1 of Wakefield shows a discrete package comprising:

- a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;
- a semiconductor chip [13] attached to the first surface of the lead frame; and
- a ceramic layer [10; col. 5, lines 18-33] having a first surface and a second surface, wherein the first surface of the ceramic layer is attached to the second surface of the lead frame;
- a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Fig. 1 of Wakefield shows most aspects of the instant invention except that the lead frame pad is held in contact with the ceramic layer by using only the molding compound. Fig. 2 of Lacap shows the heat sink [214] is held in contact with the lead frame pad [210] by using only the molding compound [204] (col. 6, lines 17-23).

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It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Lacap into the device of Wakefield in order to have the lead frame pad directly contacting the ceramic layer without an adhesive for better heat transfer.

Regarding claim 12, Fig. 2 of Lacap shows that the first surface of the ceramic layer does not contain a conductive layer.

Regarding claim 13, Fig. 2 of Lacap that the semiconductor chip [206] is attached to the first surface of the lead frame using an adhesive [210].

Regarding claim 15, Fig. 1 of Wakefield shows an electronic apparatus containing a packaged semiconductor device, the device comprising:

- a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

- a semiconductor chip [13] attached to the first surface of the lead frame;

- a ceramic layer [10; col. 5, lines 18-33] having a first surface and a second surface wherein the first surface of the ceramic does not contain a conductive layer and is attached to the second surface of the lead frame; and

- a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Fig. 1 of Wakefield shows most aspects of the instant invention except that the heat sink layer is held in contact with the lead frame pad by using only the molding compound. Fig. 2 of Lacap shows the heat sink [214] is held in contact with the lead frame pad [210] by using only the molding compound [204] (col. 6, lines 17-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Lacap into the device of Wakefield in order to have the lead frame pad directly contacting the ceramic layer without an adhesive for better heat transfer.

Regarding claim 16, Fig. 2 of Lacap shows that the first surface of the ceramic layer is directly contacts the second surface of the lead frame.

Regarding claim 17, Fig. 2 of Lacap shows that the first surface of the ceramic layer does not contain a conductive layer.

Regarding claim 19, Fig. 1 of Wakefield shows a packaged semiconductor device inherently made by a method comprising:

- providing a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

- providing a semiconductor chip [13] attached to the first surface of the lead frame;

- providing a ceramic layer [10; col. 5, lines 18-33] having a first surface and a second surface, wherein the first surface of the ceramic does not contain a conductive layer and is attached to the second surface of the lead frame; and

- providing a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Fig. 1 of Wakefield shows most aspects of the instant invention except that the heat sink layer is held in contact with the lead frame pad by using only the molding compound. Fig. 2 of Lacap shows the heat sink [214] is held in contact with the lead frame pad [210] by using only the molding compound [204] (col. 6, lines 17-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Lacap into the device of Wakefield in order to have the lead frame pad directly contacting the ceramic layer without an adhesive for better heat transfer.

Regarding claim 26, Fig. 2 of Lacap shows that the first surface of the ceramic layer does not contain a conductive layer.

Regarding claim 20, Fig. 1 of Wakefield shows a packaged semiconductor device made by a method comprising:

- providing a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

- attaching a semiconductor chip [13] attached to the first surface of the lead frame;

- attaching a first surface of a ceramic layer [10; col. 5, lines 18-33] to the second surface of the lead frame, wherein the first surface of the ceramic does not contain a conductive layer and is attached to the second surface of the lead frame; and

- encapsulating with a molding material [14] the lead frame the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Fig. 1 of Wakefield shows most aspects of the instant invention except that the heat sink layer is held in contact with the lead frame pad by using only the molding compound. Fig. 2 of Lacap shows the heat sink [214] is held in contact with the lead frame pad [210] by using only the molding compound [204] (col. 6, lines 17-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Lacap into the device of Wakefield in order to have the lead frame pad directly contacting the ceramic layer without an adhesive for better heat transfer.

Regarding claim 21, Fig. 2 of Lacap shows that the first surface of the ceramic layer is directly contacts the second surface of the lead frame.

Regarding claim 22, Fig. 1 of Wakefield shows a packaged semiconductor device made with a method wherein the encapsulation is performed using a molding material [14].

Regarding claim 23, Fig. 2 of Lacap shows that the first surface of the ceramic layer does not contain a conductive layer.

3. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wakefield in view of Lacap and Shinohara (US 6979909).

Regarding claim 25, Fig. 1 of Wakefield shows an electronic apparatus made by a method comprising:

providing a packaged semiconductor device by providing a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame,

attaching a semiconductor chip [13] attached to the first surface of the lead frame;

attaching a first surface of a ceramic layer [10; col. 5, lines 18-33] to the second surface of the lead frame, and

encapsulating with a molding material [14] the lead frame the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Wakefield shows most aspects of the instant invention, however, fails to show an electronic apparatus made by a method of providing the first surface of the ceramic layer contacting the second surface of the lead frame pad by encapsulating the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface



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and providing an outer heat sink connected to the packaged semiconductor device. Fig. 2 of Lacap shows the heat sink [214] is held in contact with the lead frame pad [210] by using only the molding compound [204] (col. 6, lines 17-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Lacap into the device of Wakefield in order to have the lead frame pad directly contacting the ceramic layer without an adhesive for better heat transfer.

The combined teachings of Wakefield/Lacap fail to show a method of providing an outer heat sink. Fig. 1 of Shinohara shows an outer heat sink [11] connected to the packaged semiconductor device.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Shinohara into the device of Wakefield/Lacap in order to provide an outer heat sink connected to the packaged semiconductor device to increase the heat dissipation.

Regarding claim 27, Fig. 2 of Lacap shows that the first surface of the ceramic layer does not contain a conductive layer.

4. Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wakefield in view of Lacap as applied to claims 1 and 6 above, and further in view of Nakanishi et al. (US 6501156), hereinafter Nakanishi.

Regarding claims 4 and 9, the combined teachings of Wakefield/Lacap show substantially the entire claimed structure except "the lead frame pad is formed to a thickness of

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0.5 mm.” Nakanishi discloses the lead frame pad with a thickness range of 0.5-0.7 mm (column 5, line 21).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Nakanishi into the device of Wakefield/Lacap in order to have to the lead frame pad with a thickness of 0.5 mm to accommodate the manufacturing specification.

### *Response to Arguments*

Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard T. Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*Douglas W. Owens 12/26/06*

DOUGLAS W. OWENS  
PRIMARY EXAMINER

jmi